

EFFECT OF PUBLIC INVESTMENTS ON PRIVATE SECTOR INVESTMENT IN NIGERIA

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Abstract

This study investigated the effect of Public Investment on Private Sector Investment in Nigeria from the period of economic liberalisation, 1986 till 2017. Public investment variables employed included government investments in transport and communication (TC), road and construction (RC), education (EI), and health sector (HI) all taken as proportion of the Gross Domestic Product (GDP); while Private investment proxied by Gross Domestic Capital Formation as percentage of GDP is the dependent variable. Data were obtained from the Central Bank of Nigeria Statistics bulletin and analysed based on the Autoregressive Distributive Lag (ARDL) model. The regression results showed that public investment has 93% significant short-run policy effect but no significant long-run effects on private sector investment in Nigeria. Specifically, the short-run effect is such that variables of road and construction, transport and communication, and education were negative at initial years of investment and graduated into positive effects after the third year. In the case of public investment in health, the short run effect degenerated from positive effect in the first years to negative effect in later years of three to four. The study posits that public investment has a mixed effect on private sector investment in the short run while it becomes insignificant in the long run. This finding follows the Ricardian Equivalence Theorem wherein economic forces are expected to counteract and offset the effect of public investment on private investment; *and thus public investment would not have effect on private investment in any economy. (Not Understood)*

Keywords: *Public investment, private sector investment, gross domestic capital formation, Ricardian equivalence theorem, autoregressive distributive lag model, Nigeria.*

1.0 Introduction

The generally believed notion about private sector investment is that it is the core driver of the economy (Njuru, 2012; Afonso & Jalles, 2011). Private sector consist of all the individuals that engage in economic activity. This group forms that the largest source of capital accumulation for productive activities in a largely capitalist economy. Hence, private sector investment is a singular largest driver of job creation. The ability of the private sector to expand the frontiers for production of goods and services makes it the core stimulator of economic activity and long-term economic growth (Ahuja, 2007).

Literatures have advocated larger proportion of private investment to Gross Domestic Product (GDP) for the developing nations to create and sustain economic growth in their domain. According to Gillis, Perkins, Roemer and Sodgrass (1987) proportion of private

investment to GDP should not be less than 15 per cent at any time. In Nigeria where infrastructural development is in short supply, private investment tends to dwindle. Nigeria can be likened to having low quality of infrastructure services relative to emerging economies like Brazil, India and South Africa that were once at comparable state with her. Over the past three decades, Nigeria has suffered poor power supply, lack of viable transport system in terms of road network, railway, sea ports and airport. This infrastructural deficit in no mean way slows down industrial activities in Nigeria. This study thus aims to investigate the effects of public sector infrastructural investment on private sector investment in Nigeria.

This is apt following the general theoretical assertion that one essential elements to reduced cost of production for the private sector is public investment, especially the one directed towards physical infrastructure development (Kahuthu, 1999). It is however plausible to believe Bahal, Raissi and Tulin, (2015) assertion that increased government investments on infrastructure facilities could complement private sector investment to engender the marginal productivity of private capital. Even public commentator claimed that some notable decline in private investment in most developed economies like the USA and Austria in the mid 1980s were due to a declining public investment witnessed those periods (Otto & Voss, 1995). All these supports the general notion that public investment engenders private investment. If this is true, it then means that governments that enhances her investments in infrastructural development will not only improve economic growth directly but also indirectly through improved private sector investment.

However, some literature suggests that public investment crowds out private investment, which would lead to substantially different policy conclusions with regard to public investment. This is an important and unsettled policy issue, which motivates this empirical examination of the effects of public investment on private investment in Nigeria.

2.0 Review of Related Literature

2.1 Conceptual Framework

Investment refers to addition to capital equipment which enables an increase in the production of capital goods (Jhingan, 2002). According to Ibenta (2005), the term investment may be defined as accumulation and commitment of fund in financial and real assets with the objective of obtaining income over time. He further noted that it is a commitment of resources made in the hope of realising benefits that are expected to occur over a reasonably long period of time in the future. Investment can also be referred to as the production of capital goods (Heim, 2008). Investment thus includes new plant and equipment, construction of public works like roads, dams, buildings, etc. Investment can be defined as the outlay of money for future use (Agu, 2015).

Investment can be made by the corporate organisation for individual stakeholders or directly by the individual in a certain project. This is known as Private Investment. When the commitment of funds for productive purposes is done by the government for the betterment of the citizenry, it is called Public Investment.

Public Investment, also known as Government Investment or Public works, arises when the government spends on infrastructural development especially on the items which no individual can conveniently provide for himself. Public Works are durable goods, primarily fixed structure, produced by the government. They comprise expenditures on infrastructural projects such as roads, rail tracks, schools, parks, buildings, airports, post offices, hospitals, irrigation canals etc. Thus, public works are strictly capital assets which are called capital expenditure (Economics discussion, 2018).

Keynes (1936) strongly believed that public works are very effective tool for enhancing growth. He noted that even an unproductive public work activity such as “digging up of holes and filling them up” are fully permissible, as an anti-depression device and has the potential

to spur growth. According to Keynes, public works is a worthwhile tool because of its ability to absorb hitherto unemployed workers, increase the purchasing power of the community and thereby stimulate the demand for consumption goods, create economically and socially useful capital assets as roads, canals, power plants, buildings, irrigation, training centres and public parks etc. and as well provide a strong incentive for the growth of industries. Thus public works programme fully satisfies the main criteria as laid down for public expenditure.

Theoretical literatures suggest that investment by the government (public investment) has effect on the level of investment by the private sector. The direction of the effect (positive or negative) on investment explained the concept of crowding in or crowding out. According to Andrade and Duarte, (2014), Crowding-out effect is such that an increase in public investment will lead to a reduction in private investment and other components of aggregate expenditure (real crowding-out), that can be sensitive to changes in interest rates (financial crowding-out). The interaction of these effects explains the fact that economic resources are scarce and there exists in the economy a transmission mechanism between financial markets and goods' markets. This scenarioplays out in the income multiplier effect when the government increase spending (or reduce taxes). The increase in total government spending will push up prices and increase the demand for money, which in turn, will cause an increase in short-run nominal interest rates. This upsurge in interest rates could afterwards bring about a drop in private investment and other components of total expenditure that is susceptible to changes in interest rate. The concept of crowding-out effect thus means a reduction in the components of the total expenditure that resulted from the increase in public investment (Blanchard, 2008).

On the other hand, the Crowding-in effect implies that fiscal policy has a positive effect on investment. Thus, an increase in government spending or reduction in taxation can lead to an increase in private investment. Succinctly put a crowding-in effect is an economic situation where an increased public investment results in an increase in private investment (Andrade & Duarte, 2014). For instance, when the government funds the construction or improvement in physical infrastructure like railways, ports, roads, water and sanitation, etc, more money is injected into the economy. The public investment as a form of expansionary fiscal measures promotes the growth of potential output by creating conditions that encourage increased productivity and a greater level of private investment (Afonso & St Aubyn, 2008).

There are two transmission channels for crowding-out or crowding-in effects: direct and indirect channels. In a direct crowding scenario, the economic activities of the government interact directly with the structure of private consumption and private economic activities (Balcerzak & Rogalska, 2014). In this scenario, private consumption will be replaced by the consumption of public goods. Succinctly, direct crowding-out or crowding-in effect results from a reduction or increase in the physical resources at the disposal of the private sector (Şen & Kaya, 2014). Government commits funds in infrastructural development to provide the essentials of life and enabling environment for private sector investment. Under an ultra-rationality hypothesis, an increase in government capital investment may crowd out private investment if the private sector views public capital investment as a substitute for private investment, and if the private sector conceives that the deficit created by public capital expenditure is tax financed (Badawi, 1999). The relationship between public investment and private investment is either complementary or substitutive. Such a relation, however, should be understood by distinguishing different contents of public investment.

The provision of public services that reduce the cost of production of the private sector would have a positive impact on the profitability of private investment. Public investment as such is expected to be a direct complement to the output produced by the private sector. The displacement of private investment by public investment is likely to be large in economies where private consumption is fairly stable (so the whole crowding outfalls on investment)

and output is supply-constrained. This will result in a direct crowding out where a naira of government investment would displace a naira of private investment expenditure.

On the other hand, an indirect crowding out occurs where the negative effect on private investment is caused by an increase in interest rates and cost of finance (Şen & Kaya, 2014). Expansion in government spending exerts an upward pressure on interest rates and thereby generates a substitution of public investment for private investment. Assuming full employment of resources and a classical labour market, the increase in public investment and thereby rise in interest rate may displace an equal amount of private investment, causing a 100% crowding out, irrespective of how the private sector views government actions, provided that consumption rate and demand for money are stable, and that monetary policy is unchanged. If resources are less than fully utilised and the economy is within its possibility frontier, expansion in public investment may partially crowd out private investment. The magnitude of displacement of private investment depends on the responsiveness of investment and demand for money functions to interest rate changes. This partial long-run relief to private investment is due to expansion in real output following an expansionary fiscal policy.

Empirical Studies

Government investments in infrastructural development are expected to boost enabling environment for private sector operations. Empirical studies that examine the effect of public works (investment) on private investment have produced conflicting results. Among these studies are Bilgili (2003) which employed the VECM models and impulse response analysis to compare the implications of fiscal policy crowding-out or crowding-in in Turkey. The study found that government investments crowd out private investment whereas its current expenditure crowd in the private investment.

Awolaja, Oluwalaiye and Lawal(2015) employed the error correction framework to examine the crowding in or crowding out effects of the composition of public investment on private investment in Nigeria from 1980 to 2010. Government investment was delineated into aggregate and sectoral central government investment expenditure. Results revealed that central government investment in defence, health, transportation and communications crowd in private investment, in the long run, thereby supporting the infrastructural hypothesis in the long-run. However, the effects of aggregate central government investment and public investment in education are positive and negative respectively but not significant. Further analyses revealed that private investment is crowded in by public investment in defence and education in the short run. The effects of both aggregate capital expenditure and public investment in transportation and communications are positive but insignificant while public investment in health has an insignificant negative effect. The study showed that public investment can either crowd in or out private investment depending on whether aggregate and sectoral central government investment criteria were considered and the time period concerned.

Mgbemena, Nwogwugwu and Kalu (2015) evaluated the determinants of private investment in Nigeria's manufacturing sub-sector between the periods 1975 and 2013 using annual time series data sourced from Central Bank of Nigeria Statistical Bulletin of various issues. In carrying out the study, econometric techniques were employed to analyse the data collected. However, stationary and co-integration tests of the variables were examined using Augmented Dickey-Fuller and Johansen co-integration tests respectively. Also, an endogenous growth model was specified and estimated using error correction mechanism (ECM) technique in order to test for the dynamic characteristics of the variables in the model. The results show that the main determinant of private investment in the manufacturing sub-sector of the Nigerian economy is the interest rate, exchange rate and public sector

investment. The study concludes that the empirically identified factors influencing private sector investment should be well-managed by the government to boost private investment in the manufacturing sub-sector and to ensure complete diversification of the Nigerian economy.

Kollamparambil and Nicolaou (2010) examined the nature and association of public and private investment in South Africa from quarterly data from 1960 to 2005. Results from the VAR model showed that public investment is not crowding in/out private investment, but exerts an indirect impact on private investment through the accelerator effect. It posits that an increase in government spending on infrastructure and social sectors is likely to enhance private investment in the country.

Using the PVAR and GMM on data obtained from 222 economic industries, Canh and Phong (2017) examined the impact of public investment on private investment and economic growth in Vietnam spanning a 27-year period from 1990 to 2016. The findings revealed that public investment including public investment and state-owned enterprise investment for production and business activities have a significant effect on economic growth in most economic industries in the short and medium term. Further results showed that public investment has a positive effect on private capital stock in the short term, but negative (crowd-out) effect in the medium term. It equally revealed a total crowds-out effect on domestic private and FDI investments in the short term and crowd-in in the mid-term.

Syed and Majeed (2008) examined the significance of government policy as a predictor of private investment in Pakistan. The study modelled public sector investment, changes in bank credit to the private sector and degree of capacity in the economy as predictors of private investment. The OLS results showed that public sector investment, changes in bank credit to the private sector and degree of capacity in the economy has a significant positive effect on private investment.

Bayraktar (2003) examined the private sector investment as a proxy for private sector development in OIC countries. The paper concentrates on private capital flows in the OIC countries: foreign direct investment, portfolio equity, bonds, bank and trade-related lending. It mainly concludes that although achieving macroeconomic stability and improving existing institutions is a long and difficult process, it is most likely to be rewarded by increased private sector investment, thus high and sustained growth.

Holcombe and Erden (2005) examined the effect of public investment in developing economies. This study gives inconsistent results on whether it complements or crowds out private investment. Applying several pooled specifications of a standard investment model to a panel of developing economies between 1980 and 1997, the study found that public investment complements private investment and that on average a 10 per cent increase in public investment is associated with a 2 per cent increase in private investment. The results also indicate that private investment is constrained by the availability of bank credit in developing economies. The same empirical model is run on a panel of developed economies. In contrast to developing economies, public investment crowds out private investment in developed economies. The results show that in a number of important ways, private investment in developed economies is influenced by different factors than private investment in developing economies.

In India, Bahal, Raissi and Tulin (2015) investigated the effect of public-capital accumulation on private investment. The study factored in the major structural changes that the Indian economy underwent in the past three decades and then undertook to examine whether public investment in recent years has become more or less complementary to private investment in comparison to the period before 1980. Secondly, it constructed a novel data-set of quarterly aggregate public and private investment in India over the period 1996Q2-2015Q1 using investment-project data from the Cap Ex-CMIE database, and then thirdly embedded a

theory-driven long-run relationship on the model to estimate a range of Structural Vector Error Correction Models (SVECMs) to re-examine the public and private investment relationship in India. The models were examined by decomposing shocks into those with transitory and permanent effects. The results indicated that public-capital accumulation crowds out private investment in India over 1950-2012, but crowded in private investment when the sample was restricted to post 1980 and conducted a quarterly analysis since 1996Q2. The study suggested that changes in public investment effects can most likely be attributed to the policy reforms which started during the early 1980s and gained momentum after the 1991 crises.

In the work of Choong, Law and Pek (2015), the relationships amongst private investment, government investments, foreign direct investment (FDI) and economic growth was investigated for Malaysia. The analyses based on the cointegration technique showed that there is a long run relationship among private investment, government spending, FDI, economic growth and interest in Malaysia. The relationships depicted that both government spending and FDI have a positive effect on private investment. Thus the study posits that government spending and FDI “crowd in” private investments both in the long run and the short run.

In Turkey, Sen and Kaya (2014) carried out a study to investigate the effect of government spending on private investment within 1975 and 2011. Several components of government spending within the budget system was captured in the modified version of David A. Aschauer’s (1989) model. The findings indicated that government current transfer spending, government current spending, and government interest spending have a significant negative effect on (crowd-out) private investment, while government capital spending has a significant positive effect (crowds-in) private investment.

Ambler, Bouakez and Cardia (2017) tested the authenticity of the Neoclassical Models within the framework of the crowding-in effect of public spending on private consumption. Using the VAR estimate on artificial data simulated from the model, the findings revealed that, given the standard assumptions to identifying public spending shocks, public spending has a significant positive effect on private consumption and the real wage. Hence, the study disagrees with the neoclassical model of crowding out the effect of public investment on private investment.

Also within the neoclassical growth framework, Badawi (1999) investigated the complementarity and substitutability of state capital to private sector investment activities. The study used the cointegration and vector autoregressive model for data analyses. The findings revealed that both private and public capital spending have stimulated economic growth in Sudan over the period 1970-98. Further to this, the study showed that private investment has a significant effect more pronounced in real growth than on the public sector investment. However, the public sector investment seems to have an adverse effect on private sector physical capital expansion. These findings revealed that public sector investment has more crowding-out categories that off-set its crowding-in effects on private investments. Thus the study posits that the crowding out effect in Sudanese weakened the favourable positive effect that the public sector’s investment has exerted on growth by jeopardising private sector capital undertakings.

Alesina, Ardagna, Perotti and Schiantarelli (1999) evaluated the effects of fiscal policy on investment using a panel of OECD countries with specific concern to investigate how different types of fiscal policy affect profits vis-à-vis investment. The study found that a sizable negative effect of public spending and in particular, of its public wage component- on business investment. The study supports the “non-Keynesian (that is, expansionary) effects of fiscal adjustments.

Njuru (2012) adopted the modified flexible accelerator model to investigate the effects of fiscal policy on private investment in Kenya from 1964 to 2010 under the vector autoregression modelling technique and error correction model framework. Results from Johansen cointegration tests of long-run relationship and Granger-Causality test revealed that fiscal policy design and implementation matters to private investment levels in Kenya. Specifically, the study indicated that taxes, government expenditure, government debt servicing and fiscal reforms could either promote or deter private investment both in the short-run and in the long-run. The study posits that suitable measures are required to adjust fiscal policy framework to ensure that it achieve other objectives of the government, including the growth of private investment.

With disaggregated government fiscal policy variables, Soli, Harvey and Hagan (2008) examined the effect of government fiscal policy on private capital investment and economic growth in Ghana. The Engel-Granger two steps technique was adopted for data analyses. The findings revealed that changes in government recurrent expenditure, current government capital expenditure and international trade taxes have significant effects on growth while changes in tax on domestic goods and services, tax on international trade and tax on income and property impact on private capital investment.

In a study was done in Kenya, Menjo and Kotut (2012) aimed to determine the effects of fiscal policy on private investment and economic growth within the time frame covering 1973 to 2009. Using a two-stage instrumental variable estimation method, the regression analyses revealed that fiscal policy has a significant effect on private investment and indirect effect on economic growth through investment.

Using a panel data set of 23 developed and 15 developing countries, Mahmoudzadeh, Sadeghi and Sadeghi (2013) examined the effect of fiscal policy on private investment within a period covering 2000 to 2009. The variables of fiscal spending were disaggregated into consumption, capital formation and budget deficit and regressed on private investment using the Fixed and Random effect models. The findings revealed that the elasticity of private investment with respect to government capital formation expenditure has positive effects in both developed and developing economies, but this complementary effect is greater than in the developed countries. In a similar vein, the elasticity of private investment with respect to government consumption spending has a significant negative in both developed and developing economies (crowd out effect), but this substitution effect is larger in developed countries. Further to this, the budget deficit has a negative effect on private investment in developed countries (crowd out effect) and positive effect in developing countries (crowd in effect). The study thus posits that public investment crowds-in private investment in developing economies, unlike the developed economies.

3.0 METHODOLOGY

The study used the ex post facto research design to examine the effect of public investment on private sector investment in Nigeria. The data was an annual time series available in secondary data form obtained from the Central Bank of Nigeria Statistical Bulletin.

The model specification is anchored on the Keynesian school of thought (that is, crowding-in-effect) that is most obtainable in a developing economy like Nigeria where there is the presence of unemployment with interest rate not being the major determinant of investment. The model is adapted from the work of Kollamparambil & Nicolaou (2010) which disintegrated public investment into Residential and Non-residential, construction works, Transport equipment and machinery and other equipment. In the present study, Transport & Communications, Roads & Construction, Education investment and health sector investment are used to proxy for public works (that is, government investment). The model is stated thus:

$$PI = f(TC, RC, EI \text{ and } HI)$$

Where:

PI= Private investment proxied by Gross Domestic Capital Formation as percentage of GDP

TC= Transport and communication investment as percentage of GDP

RC= Road and construction investment as percentage of GDP

EI = Investment in education as percentage of GDP

HI = Investment on health sector as percentage of GDP

This can be rewritten as an econometric equation of the effect of public investment (works) on private investment.

$$PI = d_0 + d_1TC + d_2RC + d_3EI + d_4HI + \varepsilon_t$$

d_0 = the constant while d_{1-4} are the coefficients of explanatory variables.

The Apriori expectation following the Keynesian view: TC, RC, EI and HI are expected to crowd-in private investment (PI).

The multiple regression technique was performed using the Eviews 9 which is computer-based econometric software. The model was analysed based on the Autoregressive Distributive Lag (ARDL) approach. The ARDL also was known as Bound Test is a cointegration approach developed by Pesaran and Shin (1999) and Pesaran, Shin and Smith (2001). This approach is adopted for analyses because it is most suitable for models in which the variables are stationarity at both level 1(0) and first differences 1(1). (Narayan, 2005). The ARDL test accommodates both the short and long run trends in testing the relationship between the dependent and independent variables and is relatively more efficient in the case of small and finite sample data sizes (Harris & Sollis, 2003).

4.0 RESULTS

4.1 Descriptive Statistics of the Variables

The descriptive properties of the variables were summarized in Table 2. The descriptive properties of the variables were highlighted based on the mean, maximum, minimum, standard deviation and number of observation. The observations showed that all the variables were collected for 32 years. This spanned 1986 to 2017, covering the market-based era in Nigeria. The current periods covered in the time frame suggest that the results from this study apply to the contemporary fiscal policy issues in Nigeria.

Table 2: Descriptive Statistics for Data Employed in the Study

	Public Investment and Private Investment Variables				
	PI	TC	RC	EI	HI
Mean	4.51	0.15	0.72	0.14	0.11
Maximum	14.39	0.43	10.88	0.35	0.40
Minimum	-5.69	0.04	0.00	0.03	0.02
Std. Dev.	4.87	0.10	1.92	0.09	0.09
Observations	32	32	32	32	32

Private sector investment (PI) is the ratio of Gross Domestic Capital Formation to GDP. The result showed a mean of 4.51 and a standard deviation (SD) of 4.87. The SD is higher than the mean suggesting a wide variation in the mean over time. The maximum and minimum values are 14.39 and -5.69 respectively. This supports the existence of high fluctuation in private sector investment in Nigeria.

The selected public works (investment) variables are Transport and Communication (TC), Road and Construction (RC), Education (EI) and Health sector (HI). The results of the Mean in Table 2 revealed that RC (0.72) received the highest level of attention compared to TC (0.15), EI (0.14) and HI (0.11). The results of the maximum and minimum are 0.43 and 0.04 for TC; 10.88 and 0.00 for RC; 0.35 and 0.03 for EI and 0.40 and 0.02 for HI respectively.

The result of the maximum and minimum value supported this assertion that RC consumed more government investment than other public investment outlets.

4.2. Stationarity Test Result

Most time series data are susceptible to an instability that can distort normal trends and affect the reliability of regression analyses. The variables were therefore subjected to stationarity test to Augmented Dickey-Fuller (ADF) Tests, to determine whether they are stationary series or non-stationary series. The null hypothesis that is tested in both unit root tests in the presence of unit root.

Table 3: ADF Test of Stationarity test for Public Investment and Private Investment Variables

Variables	At Level		First Difference		Order of Integration
	t-Statistic	Prob	t-Statistic	Prob	
PI	-1.0904	0.7069	-6.6910	0.0000	1(1)
TC	-3.3477	0.0214	-	-	1(0)
RC	-5.3265	0.0001	-	-	1(0)
EI	-3.5519	0.0130	-	-	1(0)
HI	-2.7009	0.0853	-5.9269	0.0000	1(1)

The results showed that TC, RC and EI do not have unit roots (that is, stationary) at level 1(0). The variables including PI and HI are not stationary at level 0(1). However, they (PI and HI) became stationary at first difference 1(1). From the results of the ADF tests on Tables 3, it can be seen that the variables in each of the models have a combination of level 1(0) and first difference 1(1) stationarity. Thus, the ARDL was adopted for data analyses. The variables stationary at level implies that they are not time variant while the ones stationary at first difference suggest that they respond to changes in time periods.

4.3 Estimation of Long run Effect of Public Investment on Private Sector Investment

The test of cointegration for the presence of a long-run relationship in the model is shown in Table 4. The ARDL result is used to compare the bound critical values with the F-statistics values. If the F-statistic is above the upper and lower critical bound values, then there is a long run relationship in the model; but where the F-statistics is below the upper and lower bound critical values, it is inferred that there is no long-run effect (relationship). The null hypothesis is that “No long-run relationship exists”.

Table 4: ARDL Bounds Test for long run effect of Fiscal Policies on Private Sector Investment

ARDL Bounds Test

Included observations: 28

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	2.553634	4
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
5%	2.86	4.01
1%	3.74	5.06

From the results in Table 4, the critical bound values were computed at 5% level of significance. The lower critical bound value is 2.86 while the upper critical value is 4.01. The bound values being greater than the F-statistics (2.5536) indicate that the null hypothesis cannot be rejected at the 0.05 level of significance. The study thus concludes that public investment has no long-run effect on private sector investment in Nigeria.

4.4 Estimation of Short Run Effect of Fiscal Policies on Private Sector Investment

Table 6: Short Run Model of the Relationship between Public Investment and Private Sector Investment in Nigeria

Dependent Variable: PI

Method: ARDL

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
PI(-1)	1.455249	0.334430	4.351427	0.0121
PI(-2)	0.597810	0.242815	2.462001	0.0695
PI(-3)	0.212720	0.185961	1.143896	0.3165
PI(-4)	0.107453	0.176685	0.608162	0.5759
TC	-23.95224	7.430627	-3.223448	0.0322
TC(-1)	23.18328	12.46741	1.859511	0.1365
TC(-2)	21.92616	10.59530	2.069424	0.1073
TC(-3)	11.67218	9.818018	1.188853	0.3003
TC(-4)	46.63657	9.989298	4.668653	0.0095
RC	0.191624	2.828117	0.067757	0.9492
RC(-1)	-9.140497	3.352795	-2.726232	0.0426
RC(-2)	4.412917	1.990928	2.216512	0.0910
RC(-3)	-1.462091	0.708347	-2.064088	0.1080
RC(-4)	1.378493	0.501027	2.751338	0.0413
EI	-10.71959	10.43770	-1.027007	0.3625
EI(-1)	-5.129494	11.10560	-0.461883	0.6682
EI(-2)	40.76211	15.64661	2.605172	0.0597
EI(-3)	43.68571	14.89344	2.933218	0.0427
HI	37.70780	12.84522	2.935550	0.0426
HI(-1)	21.57907	9.264228	2.329290	0.0803
HI(-2)	-24.55006	15.58848	-1.574885	0.1904
HI(-3)	-42.93980	15.84297	-2.710338	0.0535
HI(-4)	-46.87216	12.98224	-3.610485	0.0225
C	-18.66425	7.418268	-2.515985	0.0656
R-squared	0.989679			
Adjusted R-squared	0.930334			
F-statistic	16.67673			
Prob(F-statistic)	0.007123			
Durbin-Watson stat	2.448187			

The short-run effects of public investment on private sector investment is analysed using the Auto-regressive Distributive Lag (ARDL) model. The analyses are interpreted based on the coefficient of the explanatory variables, and the coefficient of determination (R²). The

statistical significance is confirmed using the t-statistics for the coefficient of regression, and F-statistics for the coefficient of determination.

The result showed that PI endogenously influences private investment within the initial year of investment. This means that a unit private sector investment will spur about 1.45% increase in private investment within the year under the public sector investment.

Public investment in Transport and communication (TC) have a negative (-23.95224) and significant (0.0322) short-run effects within the year and positive (46.6365) and significant (0.0095) effect after four years. This suggests that a unit increase in TC will result in 23.95% fall in private investment within the year which will later convert to 46.63% increase in total private investment after four years of public investment in transport and communication project.

Again, Road and construction investment (RC) had a negative (-9.1404) and significant (0.0426) short-run effects after one year and a positive (1.3784) and significant (0.0413) effect after four years. This implies that public investment in roads and construction usually has an adverse effect on private investment with the first year of road construction projects which will later in the years especially after the first four years, brings about a huge improvement in private investment to the tune of 1.37%.

Similarly, public investment on health (HI) had a positive (37.7078) and significant (0.0426) short-run effects within the investment year but became a negative (-46.872) and significant (0.0225) effect after four years. However, Education investment showed positive (43.6857) and significant (0.0427) effect after three years of initial private sector investment in Nigeria. The human capital public investments in health and education showed that health and education will engender about 37.7% and 43.68% boosts, respectively on private investment. However, private investment resulting from government health initiatives will crash by 46.87%.

On the overall, the adjusted coefficient of determination (Adj R²) revealed that about 93% of the change in private investment (PI) can be explained by public investment variables in Nigeria. Again, the computed F-statistics (16.6767) has a p.value less than 0.05 for rejection of the null hypothesis of short-run effect. The study concludes that public investment has a short run significant effect on private sector investment in Nigeria.

Conclusion and Recommendations

Public investment has 93% significant short-run policy effect but no significant long-run effects on private sector investment in Nigeria. The nature of the short-run effect is such that variables of road and construction, transport and communication, and education were negative at initial years of investment and graduated into positive effects after the third year. In the case of public investment in health, the short run effect degenerated from positive effect in the first years to negative effect in later years of three to four. This connotes that public investment has a mixed effect on private investment in the short run while it becomes insignificant in the long run. The nature of the relationship between public investment and private investment depends on whether private investors see public investment as complementary or supplementary (Badawi, 1999). The long-run insignificant relationship between public investment and private investment agrees with the Ricardian Equivalence Theorem wherein economic forces are expected to counteract and offset the effect of public investment on private investment.

The study however recommends that the government should encourage the monitoring of administrative sub-heads to ensure efficient use of funds. The study also recommends more infrastructural development in areas of roads and construction, transport and communication, and education to engender private investment.

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